PERTUSSIS

DISEASE REPORTING

In Washington

DOH receives approximately 400 to 830 reports of pertussis per year, for an average rate of 10.2/100,000 persons. On average, 1 death is associated with pertussis infection each year. Pertussis is a vaccine preventable disease among children <7 years of age; for older children and adults, there is currently no vaccine available.

Purpose of reporting and surveillance

- To identify and evaluate contacts and recommend appropriate preventive measures, including exclusion, antibiotic prophylaxis and/or immunization.
- To assist in the diagnosis of cases.
- To educate exposed persons about signs and symptoms of disease, thereby facilitating early diagnosis.
- To identify situations of undervaccination or vaccine failure.

Reporting requirements

- Health care providers: **immediately notifiable to Local Health Jurisdiction**
- Hospitals: **immediately notifiable to Local Health Jurisdiction**
- Laboratories: notifiable to Local Health Jurisdiction within 2 workdays; specimen submission required
- Local health jurisdictions: notifiable to DOH Communicable Disease Epidemiology within 7 days of case investigation completion or summary information required within 21 days

CASE DEFINITION FOR SURVEILLANCE

Clinical criteria for diagnosis

A cough illness lasting ≥ 2 weeks with one of the following: paroxysms of coughing, inspiratory “whoop,” or posttussive vomiting, without other apparent cause (as reported by a health professional).

Laboratory criteria for diagnosis

- Isolation of *Bordetella pertussis* from clinical specimen or
- Positive polymerase chain reaction assay for *B. pertussis*.

Case definition

- Probable: a case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case.
- Confirmed: person with an acute cough illness of any duration that is culture confirmed, or a case that meets the clinical case definition and is confirmed by PCR, or a case that meets the clinical case definition and is epidemiologically linked directly to a culture or PCR confirmed case.
  The clinical case definition is appropriate for endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting ≥2 weeks. Because some studies have documented that direct fluorescent antibody testing of nasopharyngeal secretions has low sensitivity and variable specificity, it should not be relied on as a criterion for laboratory confirmation. Serologic testing for pertussis is available in some areas but is not standardized and, therefore, should not be relied on as a criterion for laboratory confirmation for national reporting purposes.

A. DESCRIPTION

1. Identification

An acute bacterial disease involving the respiratory tract. The initial catarrhal stage has an insidious onset with an irritating cough that gradually becomes paroxysmal, usually within 1-2 weeks, and lasts for 1-2 months or longer. Paroxysms are characterized by repeated violent coughs; each series of paroxysms has many coughs without intervening inhalation and can be followed by a characteristic crowing or high-pitched inspiratory whoop. Paroxysms frequently end with the expulsion of clear, tenacious mucus, often followed by vomiting. Infants less than 6 months old, adolescents and adults often do not have the typical whoop or cough paroxysm.

The number of fatalities in the US is low; approximately 80% of deaths are among children under 1 year of age, and 70% are under 6 months. The case-fatality rate is less than 1% in infants under 6 months of age in the US. Morbidity is slightly higher in adult females than males. In nonimmunized populations, especially those with underlying malnutrition and multiple enteric and respiratory infections, pertussis is among the most lethal diseases of infants and young children. Pneumonia is the most common cause of death; fatal encephalopathy, probably hypoxic, and inanition from repeated vomiting occasionally occur.

In recent years in the US, pertussis has been recognized with increasing frequency in adolescents and young adults, whose symptoms varied in severity from a mild, atypical respiratory illness to the full-blown syndrome. Many of these cases occur in previously immunized persons and indicate waning immunity following immunization. Unrecognized disease among children and adults has lead to nosocomial outbreaks of pertussis.

Parapertussis is a similar but usually milder disease. It usually occurs in school age children and is relatively infrequent. Differentiation between *Bordetella parapertussis* and *B. pertussis* is based on culture, biochemical and immunologic differences. A similar acute

clinical syndrome has been reported in association with viruses, especially adenoviruses; however, the duration of cough is usually less than 28 days.

Diagnosis is based on the recovery of the etiologic organism from nasopharyngeal specimens obtained during the catarrhal and early paroxysmal stages on appropriate culture media, or identification in the same specimens by standardized polymerase chain reaction (PCR) assay. DFA staining of nasopharyngeal secretions can provide rapid presumptive diagnosis but requires an experienced laboratory technician; false positive and false negative results can occur. Serologic tests for diagnosis of pertussis have not been standardized, and these methods are best used as presumptive assays in conjunction with culture or PCR.

2. Infectious Agent

B. pertussis, the pertussis bacillus; *B. parapertussis* causes parapertussis.

3. Worldwide Occurrence

An endemic disease common to children (especially young children) everywhere, regardless of ethnicity, climate or geographic location. Outbreaks occur periodically. A marked decline has occurred in incidence and mortality rates during the past four decades, chiefly in communities with active immunization programs and where good nutrition and medical care are available. From 1980 to 1989, an average of 2,800 cases was reported annually in the US, but the number of cases increased in 1995-98, to an average of 6,500. With higher immunization levels in Latin America, reported cases declined from 120,000 in 1980 to 40,000 in 1990. Incidence rates have increased in countries where antipertussis immunization rates have fallen (e.g., England, Japan in the early 1980s and Sweden).

4. Reservoir

Humans are believed to be the only host.

5. Mode of Transmission

Primarily by direct contact with discharges from respiratory mucous membranes of infected persons by the airborne route, probably by droplets. Frequently brought home by an older sibling and sometimes by a parent.

6. Incubation period

Commonly 7-20 days.

7. Period of communicability

Highly communicable in the early catarrhal stage before the paroxysmal cough stage. Thereafter, communicability gradually decreases and becomes negligible in about 3 weeks

for nonhousehold contacts, despite persisting spasmodic cough with whoop. For control purposes, the communicable stage extends from the early catarrhal stage to 3 weeks after onset of typical paroxysms in patients not treated with antibiotics. When treated with erythromycin, the period of infectiousness usually is 5 days or less after onset of therapy.

8. Susceptibility and resistance

Susceptibility of nonimmunized individuals is universal. Transplacental immunity in infants has not been demonstrated. It is predominantly a childhood disease; incidence rates of reported (i.e., recognized) disease are highest in children under 5 years of age. Milder and missed atypical cases occur in all age groups. One attack usually confers prolonged immunity, although second attacks (some of which may be due to *B. parapertussis*) can occasionally occur. Cases in previously immunized adolescents and adults in the US occur because of waning immunity and are an increasing source of infection for nonimmunized young children.

B. METHODS OF CONTROL

1. Preventive measures:

a. Educate the public, particularly parents of infants, about the dangers of whooping cough and on the advantages of initiating immunization at 2 months of age and adhering to the immunization schedule. This continues to be important because of the wide publicity given the relatively rare adverse reactions.
b. Active primary immunization against *B. pertussis* infection is recommended with 3 doses of a vaccine consisting of a suspension of killed bacteria, usually in combination with diphtheria and tetanus toxoids adsorbed on aluminum salts (Diphtheria and Tetanus Toxoids and Pertussis Vaccine Adsorbed USP, DTP). Acellular preparations (DTaP) that contain two or more protective antigens of *B. pertussis* are used in the US for the primary (3 doses) series and booster doses. Nonadsorbed ("plain") preparations (not available except in Michigan) have no advantage, either for primary or booster immunization. In the US, DTaP is recommended to be given at 2, 4 and 6 months of age; booster doses are recommended at 15-18 months of age and at school entry. Vaccines containing pertussis are not recommended after the 7th birthday. Some countries recommend different ages of administration and/or number of doses (e.g., most developing countries give DTP vaccine at 6, 10 and 14 weeks of age).

   DTaP/DTP can be given simultaneously with oral poliovirus vaccine (OPV), inactivated poliovirus vaccine (IPV), *Haemophilus influenzae* type b (Hib), hepatitis B vaccine and measles, mumps and rubella vaccines (MMR) at different sites. Combination vaccines containing DTaP/DTP and Hib are available in the US.

   In the US, a family history of convulsive seizures is not considered a contraindication to pertussis vaccine; antipyretics may prevent febrile seizure. Immunization with DTaP or DTP should be delayed if the child has an intercurrent febrile infection; however, a mild illness, with or without fever, is not a

contraindication. In young infants with suspected evolving and progressive neurologic disease, immunization may be delayed for some months to permit the diagnosis to be established and to avoid possible confusion about the cause of symptoms. In some cases of progressive neurologic illness the child should receive DT rather than DTaP/DTP vaccine. Stable neurologic disorders, such as well-controlled seizures, are not a contraindication.

In general, pertussis vaccine is not given to persons 7 years of age or older, since reactions to the vaccine may be increased in older children and adults. Those who experience severe reactions such as convulsions, persistent or unusually severe screaming, collapse or temperature greater than 40.5ºC (greater than 105ºF) may not be given further doses of a vaccine containing pertussis if the risks outweigh the benefits. In circumstances in which further pertussis immunization is indicated (e.g., during an outbreak of pertussis), DTaP should be used. An anaphylactic reaction or acute encephalopathy within 48-72 hours of immunization is an absolute contraindication to further doses of vaccines containing pertussis. Less serious systemic and local reactions are not common after DTaP and are not contraindications to further doses of pertussis vaccine.

The efficacy of the vaccine in children who have received at least 3 doses is estimated to be 80%; protection is greater against severe disease and begins to wane after about 3 years. Active immunization started after exposure will not protect against disease resulting from that exposure, but it is not contraindicated. The best protection is obtained by adhering to the recommended schedule. Passive immunization is ineffective, and pertussis IG is no longer commercially available. Pertussis vaccine does not protect against infection by *B. parapertussis*.

c. When an outbreak occurs, consider protection of health workers who have been exposed to pertussis cases by using a 14-day course of erythromycin. Although DTaP vaccines, as of late 1999, are not recommended for persons aged 7 or older, new acellular preparations (e.g., dTaP) may be licensed for this purpose.

2. Control of patient, contacts and the immediate environment:

a. Report to local health authority. Early reporting permits better outbreak control.
b. Isolation: Respiratory isolation for known cases. Suspected cases should be removed from the presence of young children and infants, especially nonimmunized infants, until the patients have received at least 5 days of a minimum 14-day course of antibiotics. Suspected cases who do not receive antibiotics should be isolated for 3 weeks.
c. Concurrent disinfection: Discharges from nose and throat and articles soiled by them. Terminal cleaning.
d. Quarantine: Inadequately immunized household contacts less than 7 years of age should be excluded from schools, day care centers and public gatherings for 21 days after last exposure or until the cases and contacts have received 5 days of a minimum 14-day course of appropriate antibiotics.
e. Protection of contacts: Passive immunization is not effective, and the initiation of active immunization to protect against infection following recent exposure is also not effective. Close contacts under 7 years of age who have not received 4 DTaP/DTP

doses or have not received a DTaP/DTP dose within 3 years should be given a dose as soon after exposure as possible. A 14-day course of erythromycin for household and other close contacts, regardless of immunization status and age, is recommended. Data regarding the effectiveness of newer macrolides (clarithromycin, azithromycin) for chemoprophylaxis are limited.

f. Investigation of contacts and source of infection: A search for early, missed and atypical cases is indicated where a nonimmune infant or young child is or might be at risk.
g. Erythromycin shortens the period of communicability, but does not reduce symptoms except when given during the incubation period, in the catarrhal stage or early in the paroxysmal stage of the disease. Newer macrolides, such as azithromycin and clarithromycin may be effective, but data regarding their use for treatment are limited.

3. Epidemic measures

A search for unrecognized and unreported cases is indicated to protect preschool children from exposure and to ensure adequate preventive measures for exposed children less than 7 years of age. Accelerated immunization with the first dose at 4-6 weeks of age, and the second and third doses at 4-week intervals, may be indicated; immunizations should be completed for those whose schedule is incomplete.

4. International measures

Ensure completion of primary immunization of infants and young children before they travel to other countries; review need for a booster dose. WHO Collaborating Centres.